ENGR 1990 Engineering Mathematics
Homework #3 – Geometry/Trigonometry

1. The polar coordinates of an object *O* are $r = 2700$ (ft), $\theta = 60$ (deg). Find the Cartesian coordinates *x* and *y* of *O* using: a) a calculator to evaluate the trig functions, and b) the values given for commonly used angles.

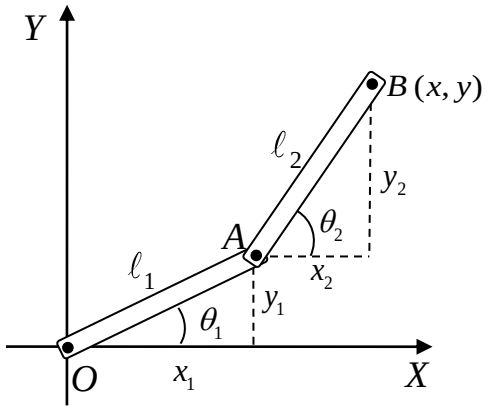
2. The polar coordinates of an object are $r = 1500$ (ft), $\theta = 210$ (deg). Find the Cartesian coordinates *x* and *y* of *O* using: a) a calculator to evaluate the trig functions, and b) the values given for commonly used angles.

3. The Cartesian coordinates of an object *O* are $x = 2750$ (ft), $y = -1500$ (ft). Find the polar coordinates *r* and θ of *O*. Express θ in both degrees and radians.

4. The Cartesian coordinates of an object *O* are $x = -1250$ (ft), $y = -1500$ (ft). Find the polar coordinates *r* and θ of *O*. Express θ in both degrees and radians.

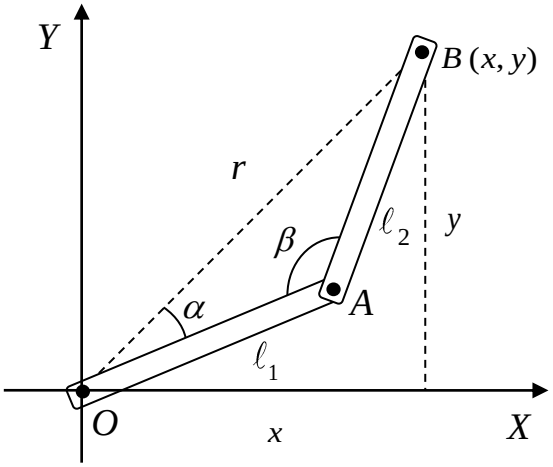
5. The angle between the line $y(x) = \frac{3}{4}x - 12$ and the *X* axis is called θ. Find the $\sin(\theta)$, $\cos(\theta)$, $\tan(\theta)$, and θ. Express θ in both degrees and radians.

6. The lengths and angles of a two link planar robot are $\ell_1 = 2.5$ (ft), $\ell_2 = 1.75$ (ft), $\theta_1 = 60$ (deg), and $\theta_2 = 30$ (deg). Find the Cartesian coordinates *x* and *y* of *B* using: a) a calculator to evaluate the trig functions, and b) the values given for commonly used angles.



7. The lengths and angles of a two link planar robot are $\ell_1 = 2.5$ (ft), $\ell_2 = 1.75$ (ft), $\theta_1 = -30$ (deg), and $\theta_2 = 60$ (deg). Find the Cartesian coordinates *x* and *y* of *B* using: a) a calculator to evaluate the trig functions, and b) the values given for commonly used angles.

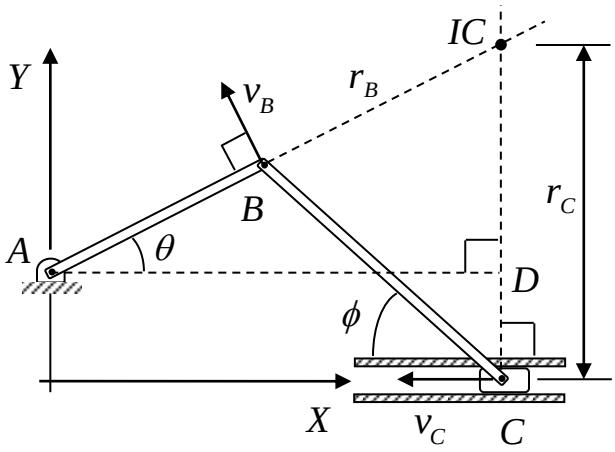
8. The *XY* coordinates of the end point *B* and the lengths of the links *OA* and *AB* are $x = 3.25$ (ft), $y = 2.4$ (ft), $\ell_1 = 2.5$ (ft), and $\ell_2 = 1.75$ (ft). Find: (a) the angles α and β, and (b) the link angles θ_1 and θ_2 for the elbow-down position. Express all angles in both degrees and radians.



9. For the slider-crank mechanism, the coordinates of points *A*, *B*, and *C* and the velocity of point *B* are

$A(0,3)$ $B(3,7)$ $C(15,0)$ (inches)

$v_B = 8$ (in/s) (in the direction shown)



a) Using the right triangle *ADIC*, find the distances r_B and r_C. Express the result in inches.

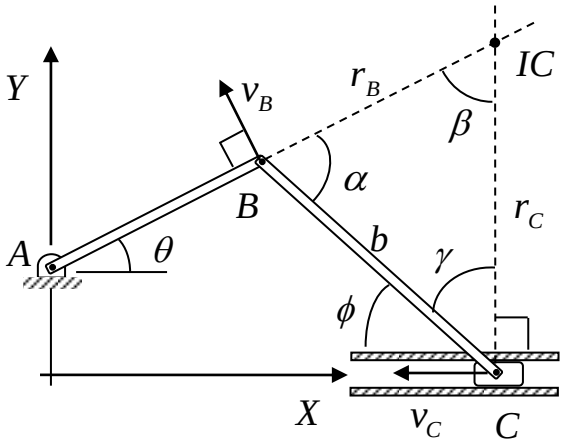
b) Find the velocity v_C. Express the result in inches/sec.

Given: $\boxed{\dfrac{v_B}{r_B} = \dfrac{v_C}{r_C}}$

10. For the slider-crank mechanism, the coordinates of points *A*, *B*, and *C* and the velocity of point *B* are

$A(0,3)$ $B(4,7)$ $C(14,0)$ (inches)

$v_B = 10$ (in/s) (in the direction shown)



a) Find the angles α, β, and γ of the non-right triangle *BCIC*. Express the results in degrees.

b) Using the law of sines, find the distances r_B and r_C.

c) Find the velocity v_C.

Given: $\boxed{\dfrac{v_B}{r_B} = \dfrac{v_C}{r_C}}$